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(54) IMPROVEMENTS RELATING TO PNEUMATIC CONVEYORS

(71) I, BERNARD KUZNIAK, of Place J. B. Moulin, 63—Lezoux, Puy-de-Dome, France, a French Citizen, do hereby declare the invention for which I pray that a patent may be granted to me and the method by which it is to be performed, to be particularly described in and by the following statement:—

In the manufacture of certain relatively fragile objects such as flat or longitudinally corrugated panels it is necessary for these panels, on leaving a machine, to be able to be stacked on a surface in such a manner as to prevent them from sliding on one another, in order to eliminate the risk of damage. A known means of solving this problem consists in using a movable head provided with suction discs which is applied against the panel and is moved in order to lay said panel gently in the position which it is to occupy. Devices of this type give full satisfaction, but they are relatively expensive.

The present invention seeks to avoid the disadvantages of known devices by means of a fixed suction box, which is disposed for example at the outlet of the machine serving for manufacture or for one stage of the manufacture of the panels in question, the panels being fed to said box one by one while rolling and the box lifting the panel and depositing it, without damaging it, on a support adapted to move vertically in order to permit the superimposition of a plurality of panels. The invention is equally utilisable in a general way for moving other substantially flat or longitudinally corrugated rectangular articles.

One device of this general type is known and which enables panels to be stacked after transport or taken from an elevator table in order to pass them to a conveyor. This apparatus comprises a parallelepipedic box which is open at its base, rotating obturators disposed along the opening and normally closing it, a flap secured to each obturator and extending across the opening when the associated obturator is closed and adapted to pivot together with the obturator in order to free

the opening when it is struck by the leading edge of the panel to be transported, this panel thus being subjected to the vacuum prevailing inside the box, and the front edge of said flap forming a compartment under vacuum in the box. In addition, when the leading edge of the panel arrives at the end of the box, it operates a valve which destroys the vacuum, and the panel is thus deposited on a table provided for the purpose. This construction is relatively complicated; for example, the means for advancing the panel comprise a complex system of endless conveyor belts which at the same time provide the airtightness of the panel in relation to the box.

According to the invention there is provided a pneumatic conveyor for substantially flat or longitudinally corrugated rectangular articles, hereinafter referred to as "panels" comprising in combination a suction source, means for advancing the panel which is to be transported in sealing contact with an opening of a suction box in communication with the suction source, and means comprising at least one flat movable device to enable the suction to be applied usefully to the panel only in the portion of said suction box facing which the panel is situated at a given moment, the suction box being divided into a number of parallel compartments by rigid vertical partitions which extend over only part of the height of the suction box, leaving above them a single chamber in communication with the suction source, while the compartment which is the first in the direction of movement of a panel is in free communication with the aforesaid chamber, at least before said panel arrives, while the others are separated from said chamber by flaps, which constitute the means for permitting the suction to be applied to the panel and which are open when no panel is present and closed when the panel closes the first compartment, thereupon being progressively opened, driving rollers constituting means for advancing the panel being provided substantially in the plane of the open-

ing and mounted in the side walls of the box, the partitions and also the walls of the box parallel to the rollers terminating their lower edges in flexible sealing skirts, the lower edges of which are situated, when at rest, in a plane parallel to the plane of the opening and substantially tangential to said rollers, the suction box having adequate dimensions sufficient to ensure that when a panel is in contact with the opening over a sufficient surface for the suction to enable it to be raised, the trailing edge of the panel, that is to say the opposite side to that which first makes contact with the opening in the box, leaves the opening of the first compartment entirely unobstructed. In one embodiment of the invention, the first compartment is also provided with a flap and means for opening said flap at the moment when the leading edge of a panel arrives level with the wall of the box.

Means are preferably also provided for maintaining at least the flap of the first compartment closed when the leading edge of the panel has cleared the opposite end wall of the box to the entry wall, in order that the panel may continue its travel instead of being laid down under the box.

Each flap (except that of the first compartment when the latter is provided with one) is preferably provided with a control rod operated by the leading edge of the panel and assisting in overcoming the inertia of the flap, in order to enable the latter to open quickly.

Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:—

Figures 1 to 4 are median longitudinal sections of a conveyor according to the invention, and respectively show:

Figure 1, the suction box ready for use; Figures 2 and 3, two stages of the engagement of a panel with the suction box;

Figure 4, the panel held by the suction box and ready to be deposited on a pile of panels, which are themselves placed on an elevator table;

Figure 5 is a median longitudinal section of a modified embodiment and shows a product in course of displacement, in the position illustrated in Figure 3.

Figure 1 shows a suction box, preferably substantially parallelepipedic in shape, which has vertical walls 1, 1a and a horizontal top wall 2, said box being open at the bottom at 3 and having in the centre of its top wall 2 a suction pipe 4 connected to a vacuum source, (not shown) represented by the arrow 5. The interior of the suction box is divided in its lower portion into a number of identical compartments, 7, 7a, 7b . . . by rigid parallel partitions 6a, 6b . . . , which preferably extend between the two walls 1a which constitute the longer sides of the suction box.

Between the tops of the partitions 6a,

6b . . . and the top 2 of the box there is provided a single suction chamber 8. The compartments 7, 7a, 7b . . . are separated from the chamber 8 by flaps 9a 9b . . . pivoted at 10a, 10b . . . at the top of the partitions 6a, 6b The compartment 7 which is the first in the direction of movement of a panel which is to be lifted with the aid of the box is in free communication with the chamber 8. Rollers 11, 11a, 11b, . . . are mounted in the walls 1a supporting the partitions 6a, 6b . . . , at least one being provided for each compartment 7, 7a, 7b . . . , and they are preferably driven by a device (not shown) in order to advance said panel. Flexible skirts 12 are fixed to the lower edge of the walls 1 and partitions 6a, 6b . . . , the lower edges of the skirts 12 being, when at rest, substantially in a horizontal plane tangent to the lower generatrices of the rollers 11, 11a, 11b . . . , or even slightly below them.

The operation of the apparatus will be clear from the foregoing description and will now be explained in greater detail with the aid of Figures 2 to 4.

When the apparatus is at rest, the weight of the flaps 9a, 9b . . . allows them to fall to the position shown in Figure 1, that is to say open. Suction applied in the pipe 4, will be too weak to raise the flaps 9, because the outside air is drawn freely into the chamber 8 through the open compartment 7.

If however a panel 13 is fed in the direction of the arrow F (Figure 3) by the machine at the outlet of which the suction box 1 is disposed, so as to close the opening of the compartment 7, by the top face of the panel, rolling on the roller 11 and possibly on the roller 11a and being in sealing contact with the skirts 12 of the wall 1 and of the partition 6a, the suction applied by the source 5 is sufficient progressively to raise the flaps 9a, 9b . . . (Figure 2). The panel 13 is therefore powerfully drawn against the opening of the compartment 7.

When the forward movement of the panel 13 continues in the direction of the arrow F and the panel starts to close the compartment 7b (Figure 3), the flap 9a opens slightly under the action of its weight, because care is taken to avoid a perfect seal between it and the partition 6b, so that the suction of the source 5 can be applied directly to the surface of the panel 13 closing the compartment 7a. The panel is thus held against the opening 3 of the box and can continue to advance by rolling under the rollers 11, 11a The process is continued until the panel 13 occupies the position shown in Figure 4, that is to say until its trailing edge has freed the compartment 7. At that moment all the flaps 9 are open and the suction created is insufficient to hold the panel 13, which is then deposited gently on a pile of panels, which themselves

are placed on an elevator table 14. A suitable automatic or manual device naturally lowers the table 14 each time a panel 13 arrives, said table having previously been brought to the desired height to prevent the panel from being damaged by its fall, so that space is left for the following panel. The skirts 12 serve to obtain the desired airtightness between the panel and the box. In practice it has been found that the apparatus according to the invention can deposit a panel on a surface situated a few centimetres below the opening 3 without the panel suffering any damage.

If it is desired to deposit the panel further on, a second, identical box can be situated in line with the first and means may be provided to close the compartments of the first box automatically during the time required for bringing the panel into engagement with the second box.

Conversely, the presence of the skirts 12 makes it possible for an unprocessed panel laid on a table 14 to be picked up and discharged at the inlet of a machine which will subject it to suitable treatment.

In the modification shown in Figure 5, which corresponds to the working stage illustrated in Figure 3, the compartment 7 is provided with a flap 15 which can be operated for example by a small motor, which is brought into operation either by a contact moved by the leading edge of the panel 13 or by a contact which is closed when the trailing edge of the panel 13 is about to leave the compartment 7, in order that, in the first case the normal operation of the installation may be permitted and, in the second case, the panel 13 is prevented from being laid down immediately, since the release of the compartment 7 makes the suction of the source 5 ineffective.

In addition, in this modification the flaps 9a, 9b . . . are advantageously provided with small metal feeler rods 16a, 16b which project into the compartment following the one in which the flap in question is situated, these rods being struck by the leading edge of the panel 13, thereby tending to overcome the inertia of the flaps. The partitions 6b, 6c . . . and the wall 1 of the box situated on the right in Figure 5 are pierced with slots 17a, 17b . . . and 18 respectively for the passage of the rods 16a, 16b . . . , while the partition 6a is unperforated. This construction has the advantage of permitting the transport of panels placed end to end and thus of increasing output, while in addition enabling a panel to be brought into engagement with a second box disposed at the outlet of the first, as previously indicated.

The box according to the invention is capable of other practical applications. Mention in particular may be made of the following:

The sorting of panels passing out of a machine;

In a continuous roller driven chain, the passing of the panels from one direction into a different direction;

The increase of the output of the installation by making the box movable (like known suction disc devices); experience has proved that, for example, panels of 1.20m x 2.50m could be transported by a suction box device at a maximum rate of eight per minute. This figure is more than doubled if a box according to the invention is used.

Experience has proved that excellent results are obtained by using as the suction source 5, a 30cm vapour exhauster driven by a 1/3 HP motor and providing a suction of 1 gram/cm², in order to support a panel of a thickness of 1cm applying to the roller train 11 a pressure equal to 60% of the weight of the panel.

In one modified embodiment of the invention, the flaps 9a, 9b . . . could be mounted otherwise than pivotally. Also, the suction box could be made movable vertically with the aid of any convenient system, for example pneumatic power cylinders, so that the elevator table 14 could be dispensed with.

WHAT I CLAIM IS:—

1. A pneumatic conveyor for substantially flat or longitudinally corrugated rectangular panels as hereinbefore defined, comprising in combination a suction source, means for advancing the panel which is to be transported in sealing contact with an opening of a suction box in communication with the suction source, and means comprising at least one flat movable device to enable the suction to be applied usefully to the panel only in the portion of said suction box facing which the panel is situated at a given moment, the suction box being divided into a number of parallel compartments by rigid vertical partitions which extend over only part of the height of the suction box, leaving above them a single chamber in communication with the suction source, while the compartment which is the first in the direction of movement of a panel is in free communication with said chamber, at least before arrival of said panel, while the others are separated from said chamber by movable flaps, which constitute the means permitting the suction to be applied to the panel and which are open when no panel is present and closed when the panel closes the first compartment, thereupon being progressively opened, driving rollers which constitute the means for advancing the panel being disposed substantially in the plane of the opening and mounted in the side walls of the suction box, the partitions and also the walls of the suction box which are parallel to the rollers terminating at their lower edges in flexible sealing skirts, the lower edges of

which are situated, when at rest, in a plane parallel to that of the opening and substantially tangential to said rollers, the suction box having dimensions sufficient to ensure
5 that when a panel is in contact with the opening over a sufficient surface for the suction to enable it to be raised, the trailing edge of the panel, that is to say the opposite edge to that by which the panel came into
10 contact with the opening of the suction box, leaves the opening of the first compartment entirely unobstructed.

2. A conveyor according to claim 1, wherein the first compartment is also provided with
15 a flap and with means for opening said flap at the moment when the leading edge of the panel arrives level with the wall of the suction box.

3. A conveyor according to claim 1 or
20 claim 2, wherein means are provided for maintaining at least the flap of the first compartment closed when the leading edge of the panel has cleared the opposite end wall of

the suction box to the entry wall, in order that the panel may continue its travel instead
25 of being released under the box.

4. A conveyor according to claim 1, wherein the first compartment is in free communication with the common suction chamber.

5. A conveyor according to claim 1, wherein the flap of each compartment, other than
30 the first in the direction of transport, is provided with a control rod operated by the leading edge of the panel and operative to reduce the inertia of the flap.

6. A pneumatic conveyor substantially as
35 hereinbefore described with reference to the accompanying drawings.

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Fig. 2

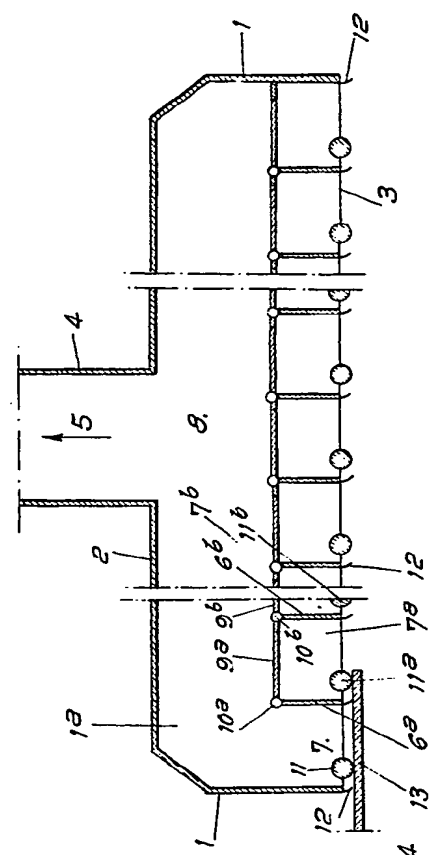


Fig. 1

